

# EXHIBIT 4

SECOND AMENDED EXHIBIT A: P.R. 3-1(C) CHART FOR U.S. PATENT NO. 6,072,450

Plaintiff Solas OLED Ltd. (Solas) provides this chart based upon information that is presently available to it. Solas has not had access to Samsung's confidential design documents or to other materials that may become available during discovery. Solas reserves the right to change or provide more detail to the infringement theories set forth below, based upon information that it learns during this case, subject to the Court's rules and orders.

*Definitions:*

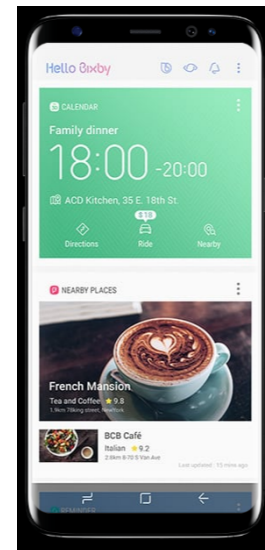
The term '450 Accused Instrumentalities is defined in Section I.B.1 of Plaintiff Solas OLED Limited's Disclosure of Asserted Claims and Infringement Contentions.

*Claim Element*

*'450 Accused Instrumentalities*

1. A display apparatus comprising:

To the extent the preamble is deemed limiting, the '450 Accused Instrumentalities comprise a display apparatus. For example, the Samsung Galaxy S8 contains an OLED display panel:

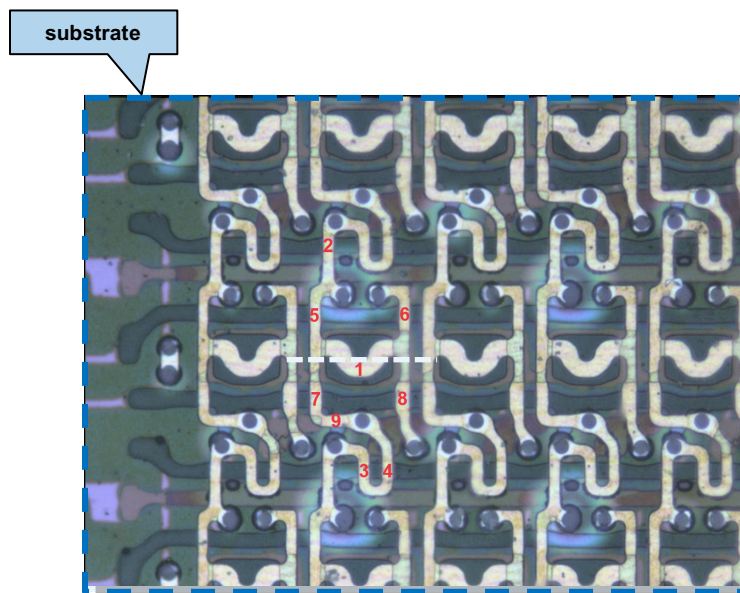


*Claim Element*

*'450 Accused Instrumentalities*

[1a] a substrate;

The '450 Accused Instrumentalities comprise a substrate. For example, the Samsung Galaxy S8 contains a polyimide substrate:

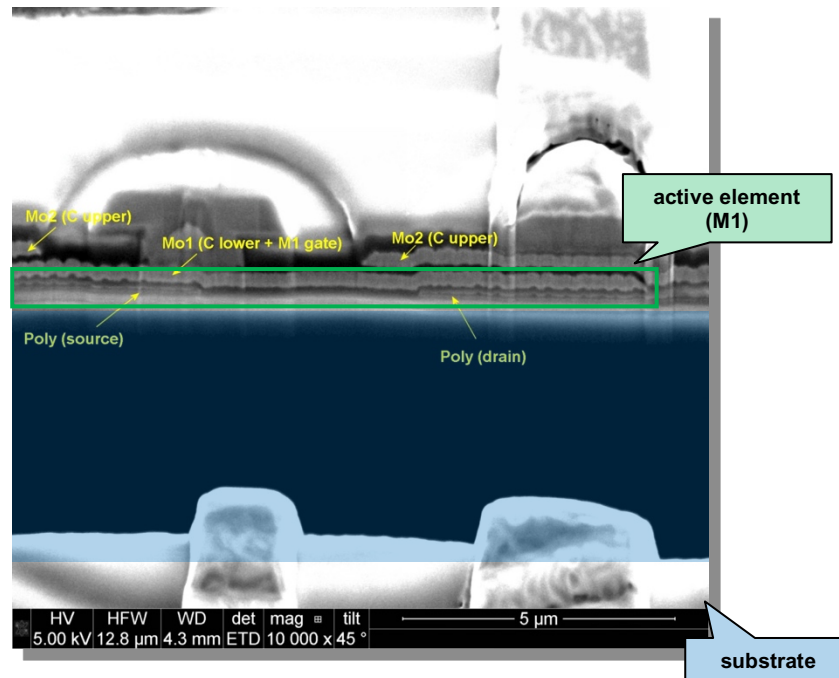


*Claim Element*

*'450 Accused Instrumentalities*

[1b] active elements formed over said substrate and driven by an externally supplied signal;

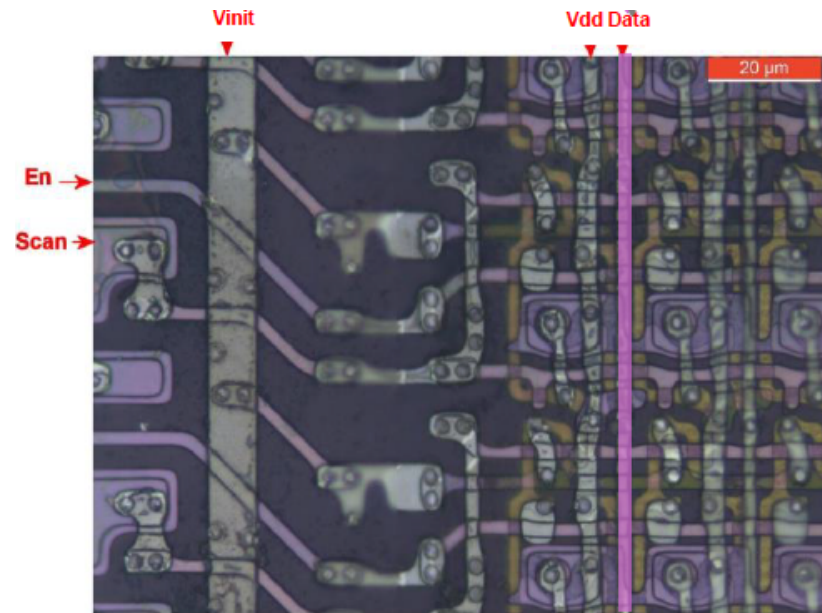
The '450 Accused Instrumentalities comprise active elements formed over said substrate and driven by an externally supplied signal. For example, the Samsung Galaxy S8 contains active elements formed over the substrate:



*Claim Element*

*'450 Accused Instrumentalities*

These active elements are driven by an externally supplied signal, labeled “Data” below:

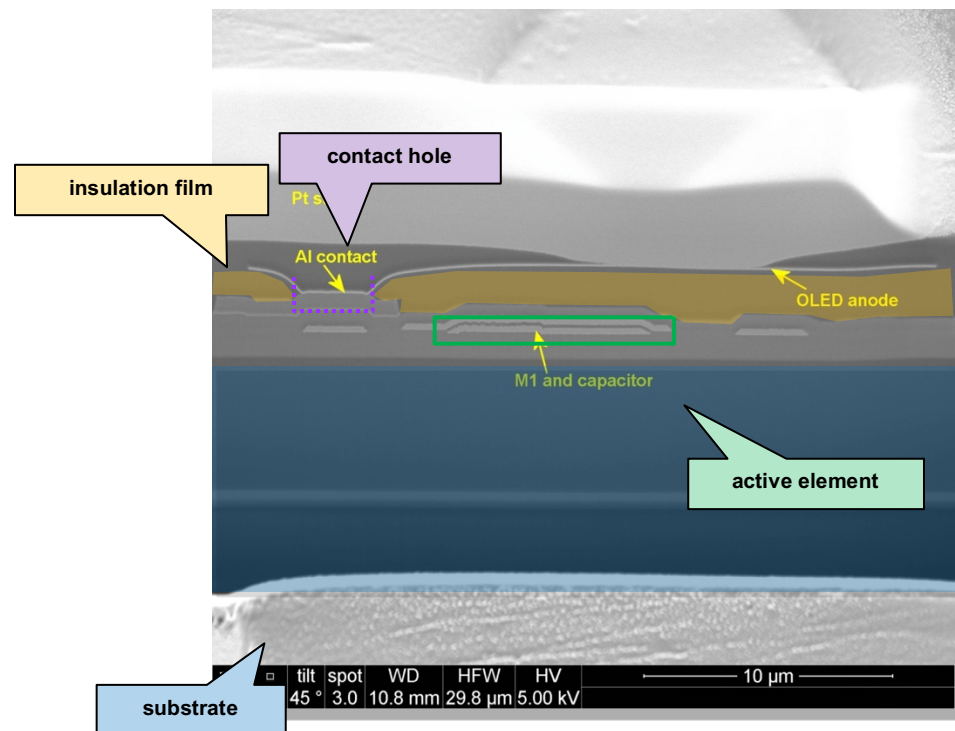


*Claim Element*

*'450 Accused Instrumentalities*

[1c] an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;

The '450 Accused Instrumentalities comprise an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole. For example, in the Samsung Galaxy S8, an insulation film is formed over the substrate, covers the active elements, and has contact holes:

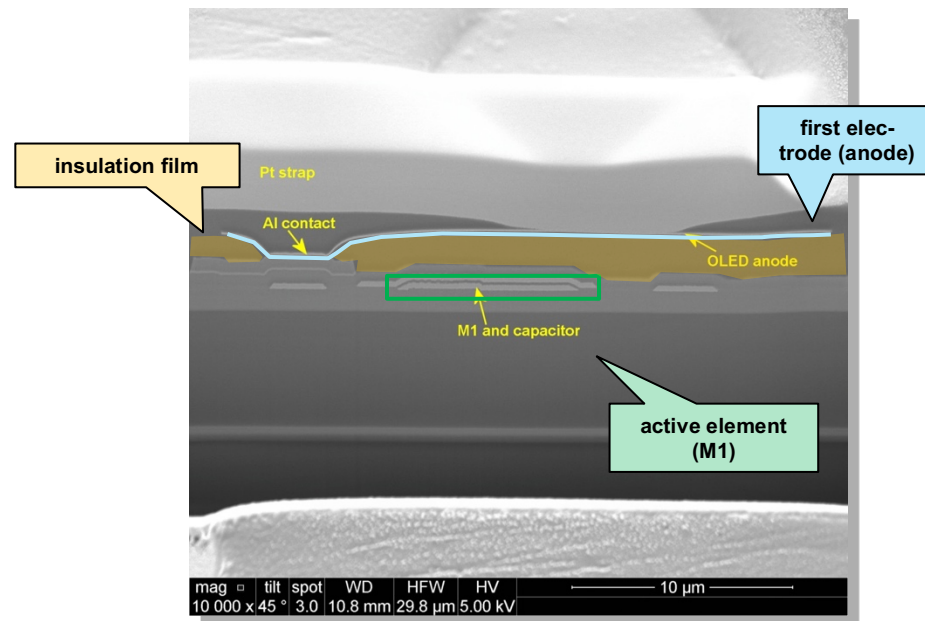


*Claim Element*

*'450 Accused Instrumentalities*

[1d] at least one first electrode formed on said insulation film so as to cover said active elements, and connected to said active elements through said at least one contact hole, said at least one first electrode being made of a material which shields visible light;

The '450 Accused Instrumentalities comprise at least one first electrode formed on said insulation film so as to cover said active elements, and connected to said active elements through said at least one contact hole, said at least one first electrode being made of a material which shields visible light. For example, in the Samsung Galaxy S8, an electrode is formed on the insulation film, covers active elements, and is connected to active elements through contact holes:



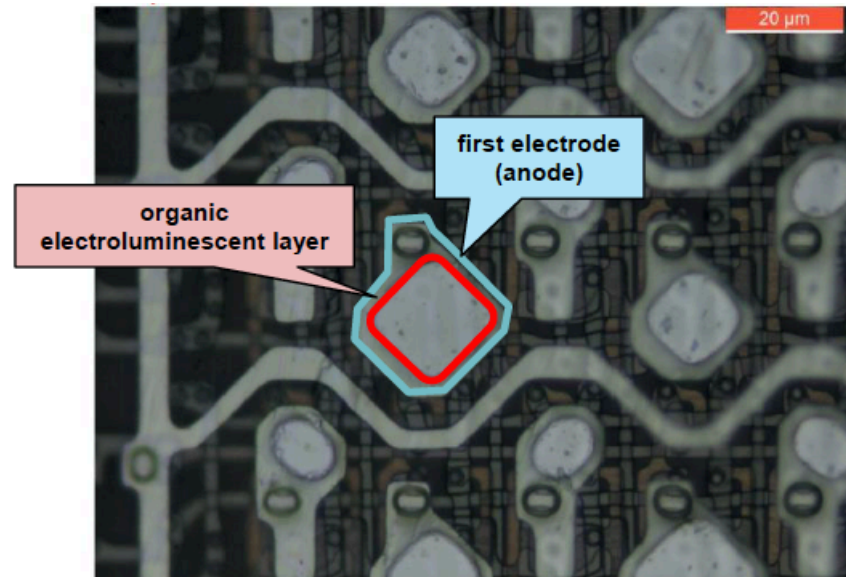
This electrode is formed of silver, which shields visible light.

*Claim Element*

*'450 Accused Instrumentalities*

[1e] an organic electroluminescent layer having an organic electroluminescent material formed on said at least one first electrode so as to cover said active elements and including at least one layer which emits light in accordance with a voltage applied to said at least one layer; and

The '450 Accused Instrumentalities comprise an organic electroluminescent layer having an organic electroluminescent material formed on said at least one first electrode so as to cover said active elements and including at least one layer which emits light in accordance with a voltage applied to said at least one layer. For example, in the Samsung Galaxy S8, a layer of organic electroluminescent material is formed on the electrode, and covers active elements:

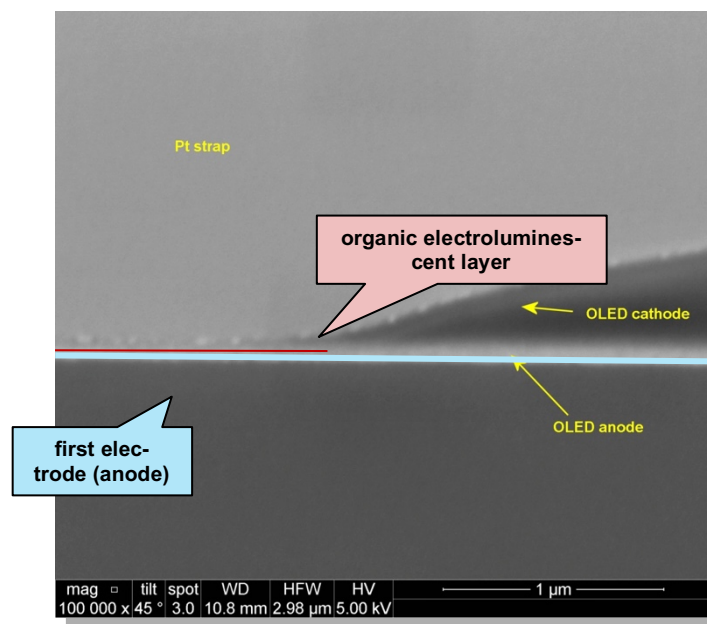




*Claim Element*

*'450 Accused Instrumentalities*

This organic electroluminescent layer emits in accordance with a voltage applied to the layer using the OLED cathode and anode:

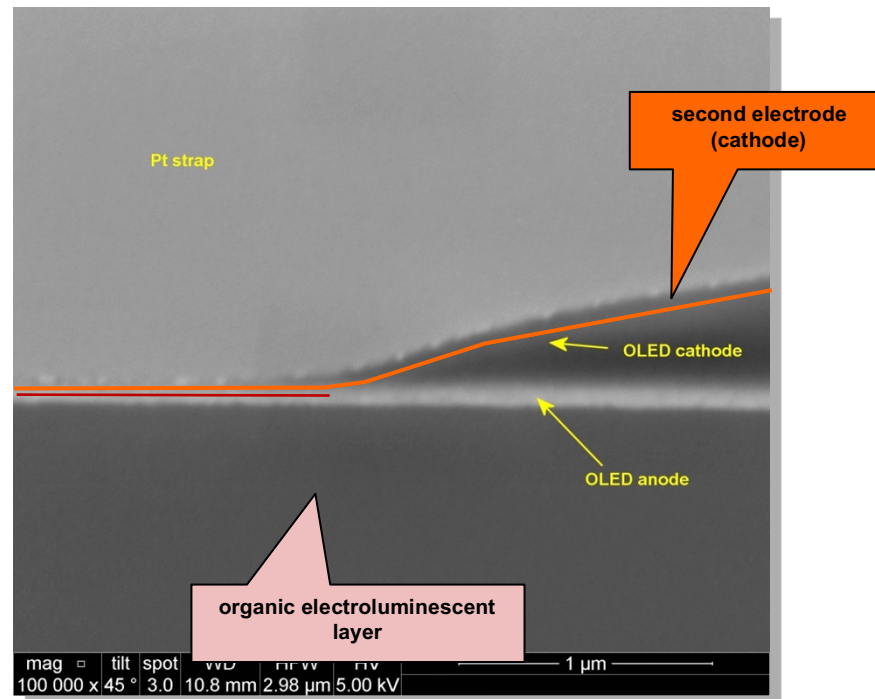


*Claim Element*

*'450 Accused Instrumentalities*

[1f] at least one second electrode formed on said organic electroluminescent layer which covers said active elements.

The '450 Accused Instrumentalities comprise at least one second electrode formed on said organic electroluminescent layer which covers said active elements. For example, in the Samsung Galaxy S8, a second electrode is formed on the organic electroluminescent layer:

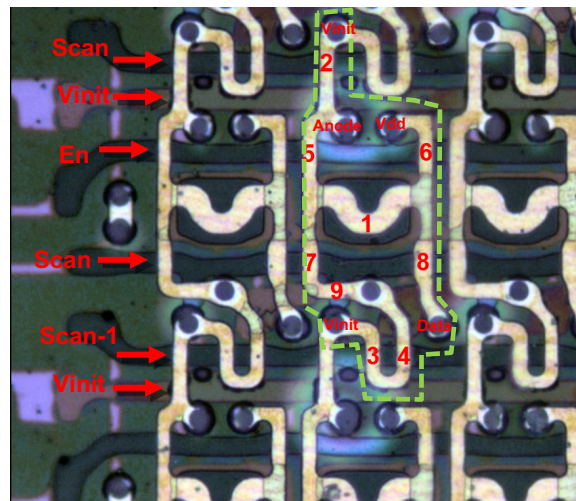


*Claim Element*

*'450 Accused Instrumentalities*

4. The display apparatus according to claim 1, wherein said active elements are a selection transistor which is turned on in response to an externally supplied address signal and a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer, said selection transistor and said drive transistor forming a pair.

The '450 Accused Instrumentalities comprise a display apparatus according to claim 1, wherein said active elements are a selection transistor which is turned on in response to an externally supplied address signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer, said selection transistor and said drive transistor forming a pair. For example, in the Samsung Galaxy S8, the active elements include a selection transistor (see, for example, labels 7 and 9 below) and a drive transistor (see, for example, label 1 below):



The selection transistor shown above is turned on in response to an externally supplied address signal (see, for example, label “Scan” above). The drive transistor is driven by a signal corresponding to image data supplied externally (see, for example, label “Data” above). As shown above, the selection transistor and drive transistor form a pair.

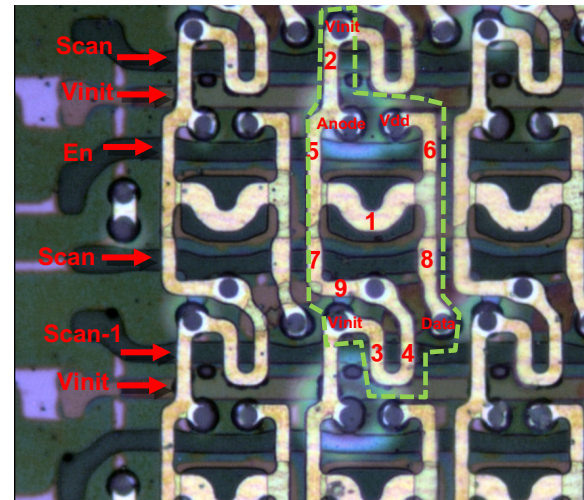
*Claim Element*

*'450 Accused Instrumentalities*

To the extent that Samsung contends elements labeled 7 and/or 9 in the image above do not literally satisfy the “selection transistor” element, that element is present under the doctrine of equivalents. To the extent that Samsung contends the element “said active elements are . . .” is not literally present in the accused products, that element is present under the doctrine of equivalents.

5. The display apparatus according to claim 4, wherein said at least one first electrode is connected to said drive transistor through said at least one contact hole.

In the '450 Accused Instrumentalities, the at least one first electrode is connected to said drive transistor through said at least one contact hole. For example, in the Samsung Galaxy S8, the first electrode is connected to the drive transistor (see, for example, label 1 below) through a contact hole (see, for example, label “anode” below):

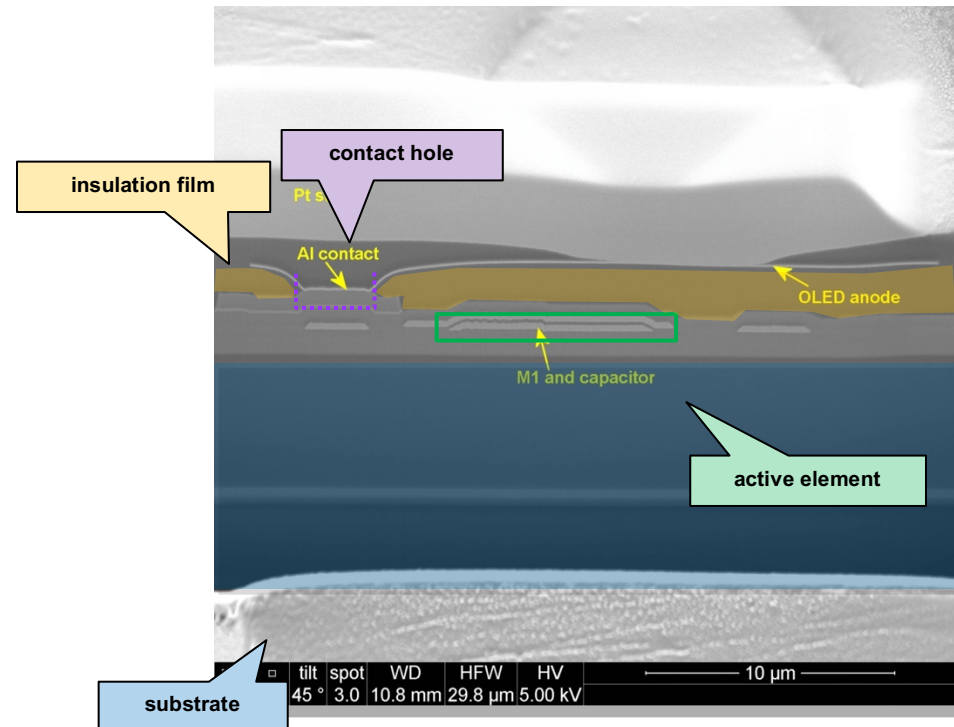


*Claim Element*

*'450 Accused Instrumentalities*

6. The display apparatus according to claim 4, wherein: said display apparatus further comprises a capacitor for retaining the signal corresponding to the image data externally supplied through said selection transistor while said selection transistor is on; and while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor.

In the '450 Accused Instrumentalities, the display apparatus further comprises a capacitor for retaining the signal corresponding to the image data externally supplied through said selection transistor while said selection transistor is on; and while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor. For example, in the Samsung Galaxy S8, the display apparatus contains a capacitor (label, for example, below) retaining the signal corresponding to the image data while the selection transistor is on, and while the selection transistor is off, the drive transistor is driven by the signal retained in the capacitor:

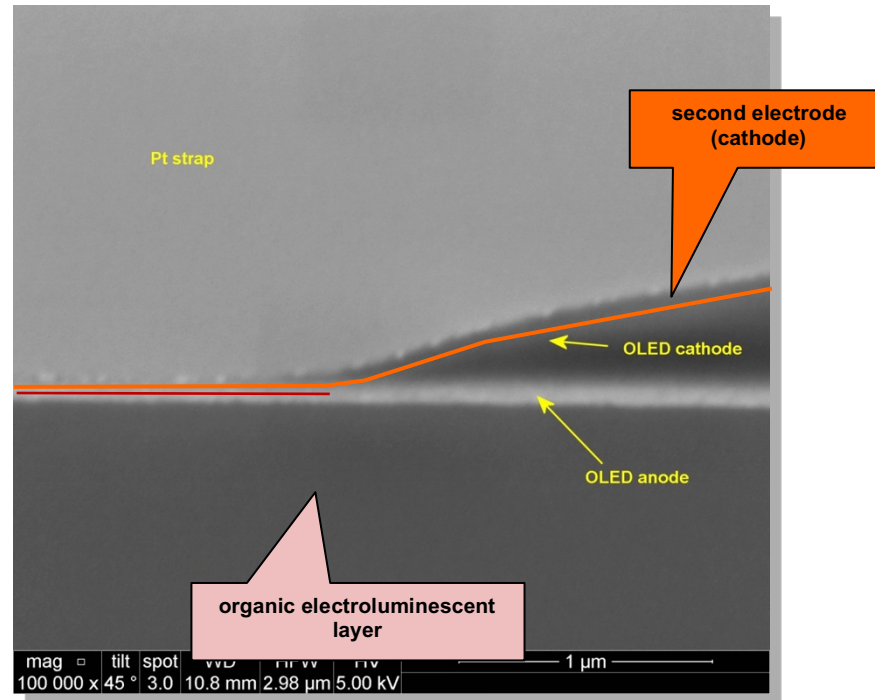


*Claim Element*

*'450 Accused Instrumentalities*

8. The display apparatus according to claim 1, wherein a constant voltage is applied to said second electrode.

The '450 Accused Instrumentalities comprise a display apparatus according to claim 1, wherein a constant voltage is applied to said second electrode. For example, in the Samsung Galaxy S8, a constant voltage is applied to said second electrode:

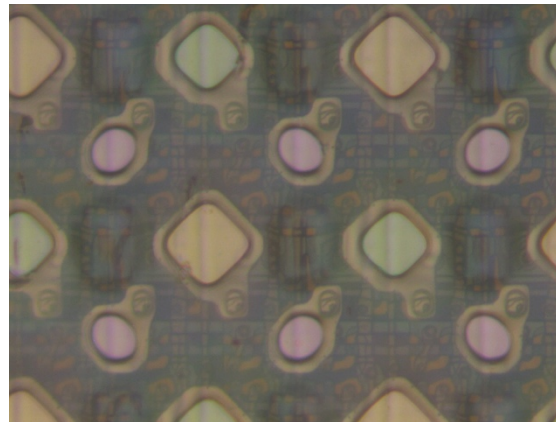


12. The display apparatus according to claim 1, wherein: said display apparatus further comprises at least one filter formed above said at least one second electrode; and light rays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

In the '450 Accused Instrumentalities, the display apparatus further comprises at least one filter formed above said at least one second electrode; and light rays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter. On information and belief, one or more of the '450 Accused Instrumentalities contain a red, green, and blue color filter positioned above the cathode for each respective sub-pixel, selectively permitting light rays in red, green, and blue wavelength ranges respectively pass through each filter.

As an example, in the Galaxy S6, a color filter layer comprising RGB filters are disposed over the OLED emitter layer, where each RGB sub-pixel is associated with a respective RGB color filter as shown below. The images are true color images. In the left-hand image, the blue/purple-colored portions of roughly oval shape correspond to a filter that allows green visible-spectrum light to pass; the yellow-colored portions of roughly diamond shape correspond to a filter that allows blue visible-spectrum light to pass; and the green-colored portions of roughly diamond shape correspond to a filter that allows red visible-spectrum light to pass.

RGB filter



OLED level (RGB filter removed)



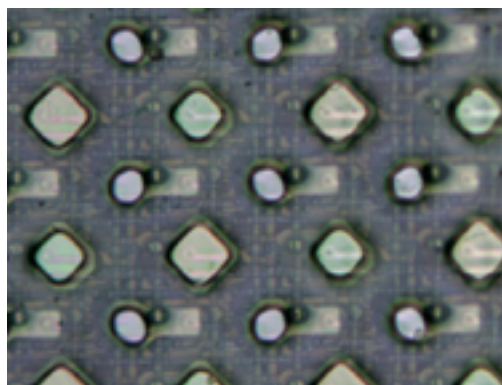


*Claim Element*

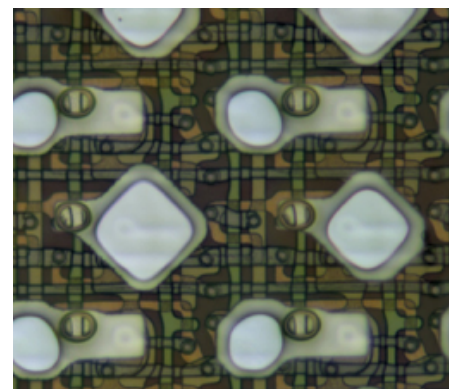
*'450 Accused Instrumentalities*

As another example, in the Galaxy S7 edge, an organic overcoat layer (which provides RGB spectrum filtering) is disposed over the OLED emitter layer, where each RGB sub-pixel is associated with a respective RGB color filter as shown below. In this example, the images are true color images. In the left-hand image, the blue/purple-colored portions of roughly oval shape correspond to a filter that allows green visible-spectrum light to pass; the yellow-colored portions of roughly diamond shape correspond to a filter that allows blue visible-spectrum light to pass; and the green-colored portions of roughly diamond shape correspond to a filter that allows red visible-spectrum light to pass.

Organic overcoat layer



OLED level (overcoat layer removed)



13. The display apparatus according to claim 12, wherein said at least one filter has a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength range pass through, and a

In the '450 Accused Instrumentalities, the filters include a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength range pass through, and a blue filter which makes light in a blue wavelength range pass through. On information and belief, one or more of the '450 Accused Instrumentalities contain a red, green, and blue color filter positioned above the cathode for each respective sub-



*Claim Element*

*'450 Accused Instrumentalities*

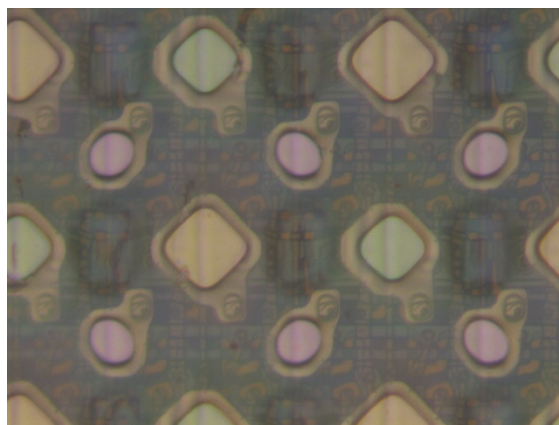
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blue filter which makes light in a blue wavelength range pass through.

pixel, selectively permitting light rays in red, green, and blue wavelength ranges respectively pass through each filter.

As an example, in the Galaxy S6, a color filter layer comprising RGB filters are disposed over the OLED emitter layer, where each RGB sub-pixel is associated with a respective RGB color filter as shown below. The images are true color images. In the left-hand image, the blue/purple-colored portions of roughly oval shape correspond to a filter that allows green visible-spectrum light to pass; the yellow-colored portions of roughly diamond shape correspond to a filter that allows blue visible-spectrum light to pass; and the green-colored portions of roughly diamond shape correspond to a filter that allows red visible-spectrum light to pass.

RGB filter



OLED level (RGB filter removed)

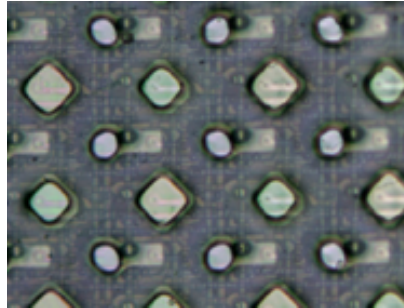


As another example, in the Galaxy S7 edge, an organic overcoat layer (which provides RGB spectrum filtering) is disposed over the OLED emitter layer, where each RGB sub-pixel is associated with a respective RGB color filter as shown below. In this example, the images are true color images. In the left-hand image, the blue/purple-colored portions of roughly oval shape correspond to a filter that allows green visible-spectrum light to pass; the yellow-colored portions of roughly diamond shape correspond to a filter that allows blue visible-spectrum light to pass; and the green-colored portions of roughly diamond shape correspond to a filter that allows red visible-spectrum light to pass.

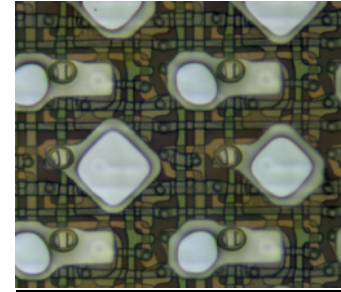
*Claim Element*

*'450 Accused Instrumentalities*

Organic overcoat layer

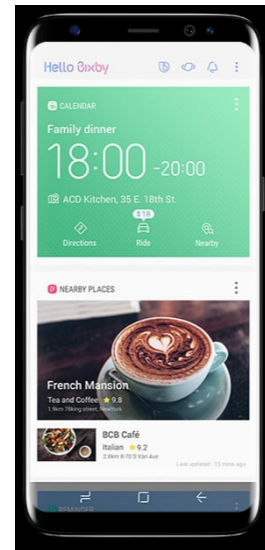


OLED level (overcoat layer removed)



15. A display apparatus comprising:

To the extent the preamble is deemed limiting, the '450 Accused Instrumentalities comprise a display apparatus. For example, the Samsung Galaxy S8 contains an OLED display panel:

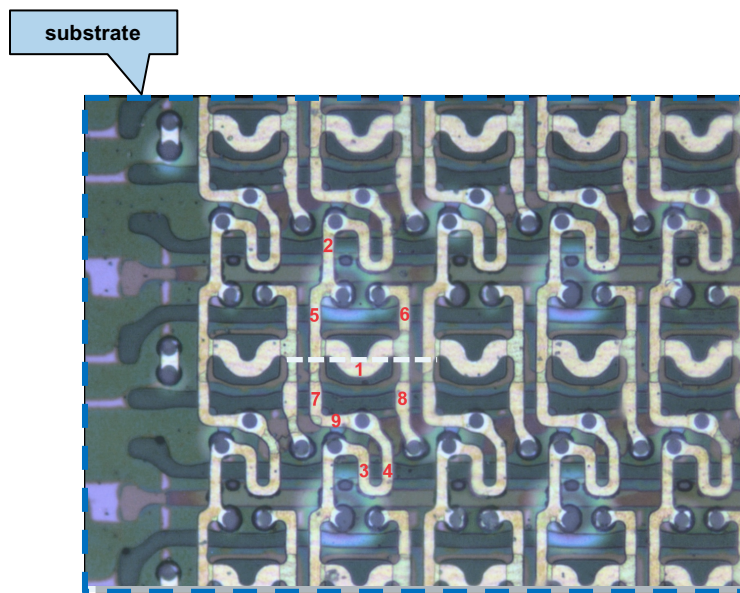


*Claim Element*

*'450 Accused Instrumentalities*

[15a] a substrate;

The '450 Accused Instrumentalities comprise a substrate. For example, the Samsung Galaxy S8 contains a polyimide substrate:

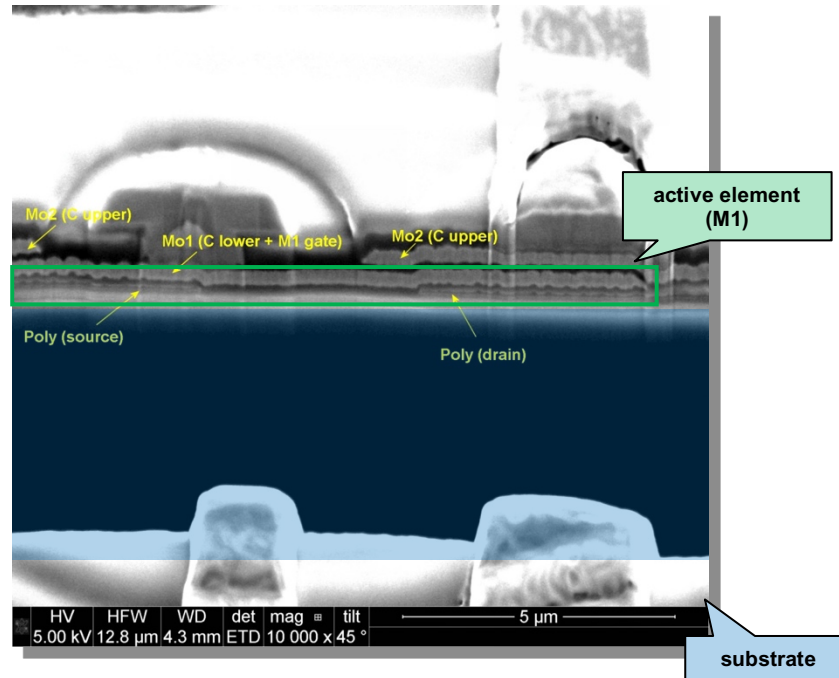


*Claim Element*

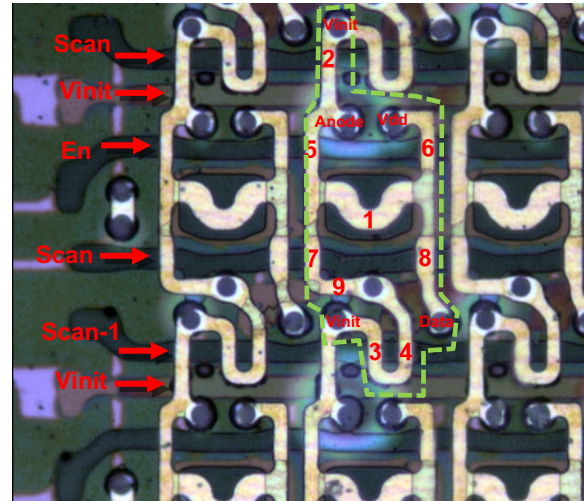
*'450 Accused Instrumentalities*

[15b] selection transistors formed over said substrate and arranged in a matrix pattern;

The '450 Accused Instrumentalities comprise selection transistors formed over said substrate and arranged in a matrix pattern. For example, the Samsung Galaxy S8 contains active elements formed over the substrate:



The active elements include selection transistors (see, for example, labels 7 and 9 below):



As shown above the selection transistors corresponding to the various pixels are arranged in a matrix pattern.

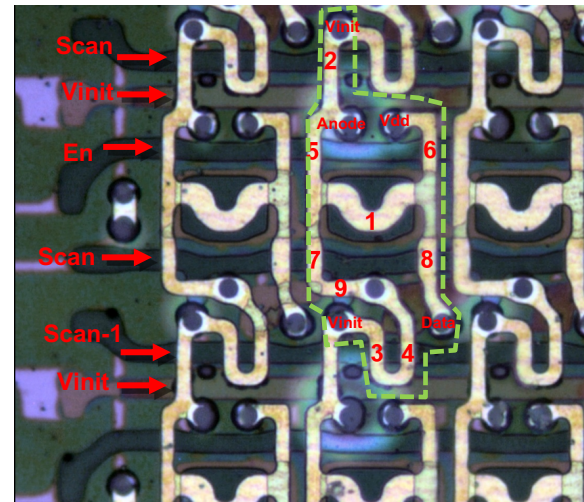
To the extent that Samsung contends elements labeled 7 and/or 9 in the image above do not literally satisfy the “selection transistors . . . arranged in a matrix pattern” element, that element is present under the doctrine of equivalents.

*Claim Element*

*'450 Accused Instrumentalities*

[15c] drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors;

The '450 Accused Instrumentalities comprise drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors. For example, in the Samsung Galaxy S8, the active elements include drive transistors (see, for example, label 1 below):



As shown above the drive transistors corresponding to the various pixels are arranged in a matrix pattern. Each drive transistor (see label 1) is connected to a selection transistor (see labels 7 and/or 9).

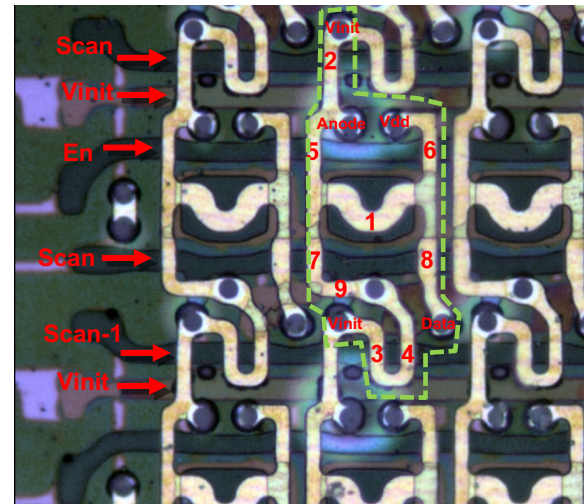


*Claim Element*

*'450 Accused Instrumentalities*

[15d] address lines connected to said selection transistors and through which a signal for turning on said selection transistors is supplied;

The '450 Accused Instrumentalities comprise address lines connected to said selection transistors and through which a signal for turning on said selection transistors is supplied. For example, in the Samsung Galaxy S8, address lines (see, for example, the “Scan” line below) are connected to the selection transistors and carry a signal for turning on the selection transistors:



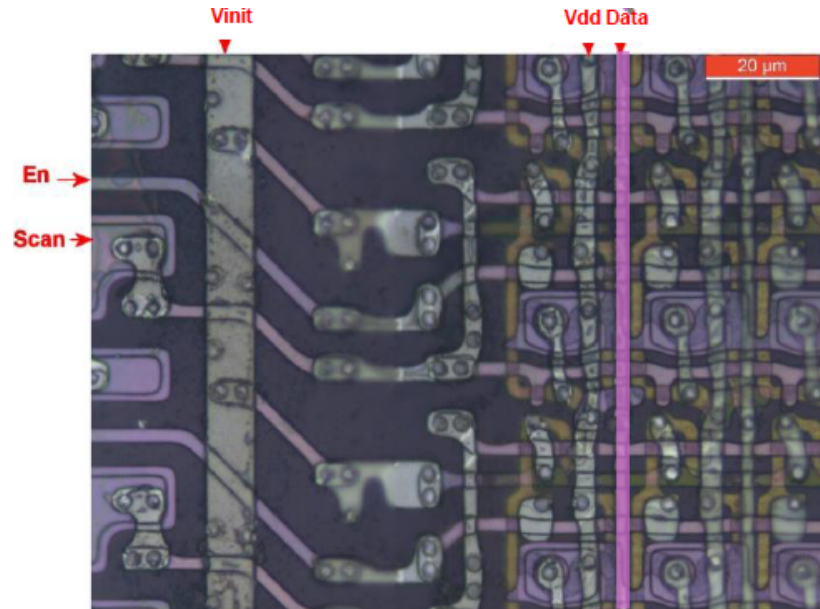


*Claim Element*

*'450 Accused Instrumentalities*

[15e] data lines connected to said selection transistors, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on;

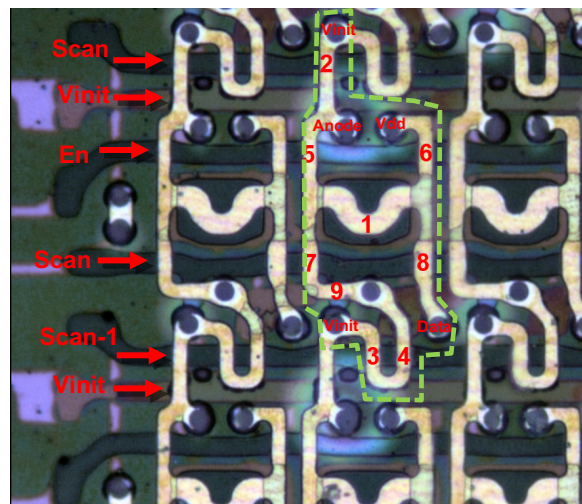
The '450 Accused Instrumentalities comprise data lines connected to said selection transistors, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on. For example, the Samsung Galaxy S8 contains data lines such as that labeled "Data" below:



*Claim Element*

*'450 Accused Instrumentalities*

A signal which corresponds to image data is supplied to the drive transistors (see label 1) through the data lines and the selection transistors (see labels 7 and 9) while said selection transistors are on:

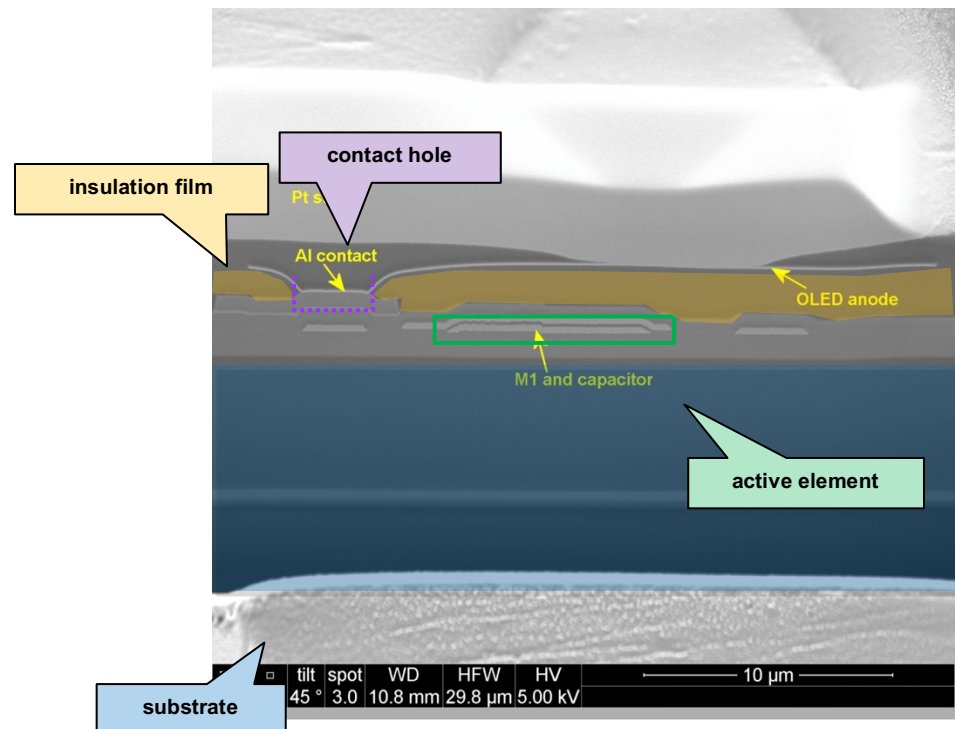


*Claim Element*

*'450 Accused Instrumentalities*

[15f] an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors;

The '450 Accused Instrumentalities comprise an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors. For example, in the Samsung Galaxy S8, an insulation film is formed over the substrate, covers the drive transistors, address lines, and data lines, and has contact holes in correspondence with the drive transistors (see label M1):

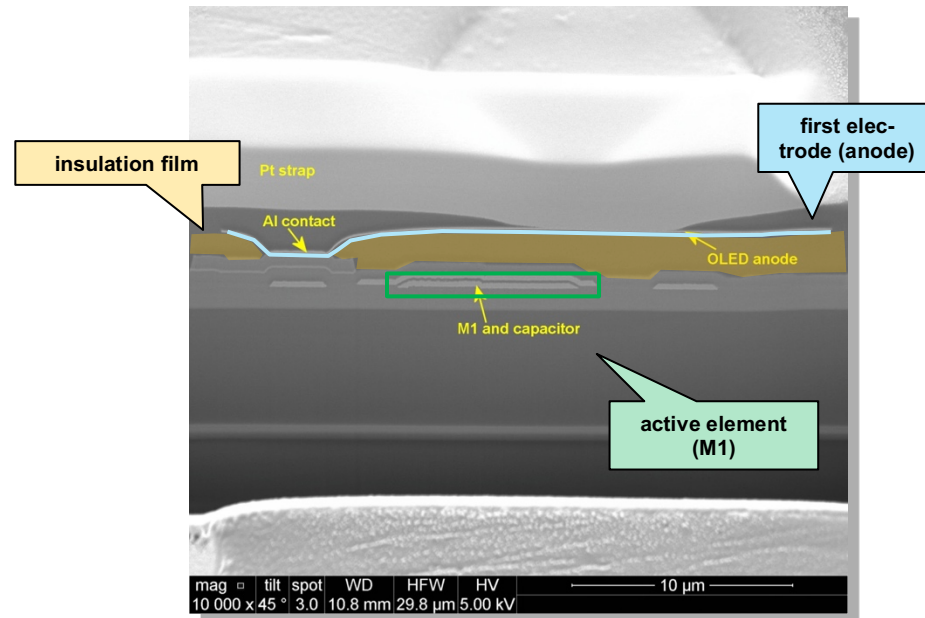


*Claim Element*

[15g] first electrodes made of a material which shields visible light, and formed on said insulation film so as to cover said selection transistors and said drive transistors, said first electrodes being arranged in a matrix pattern in areas surrounded by said address lines and said data lines, and being connected to said drive transistors through said contact holes;

*'450 Accused Instrumentalities*

The '450 Accused Instrumentalities comprise first electrodes made of a material which shields visible light, and formed on said insulation film so as to cover said selection transistors and said drive transistors, said first electrodes being arranged in a matrix pattern in areas surrounded by said address lines and said data lines, and being connected to said drive transistors through said contact holes. For example, in the Samsung Galaxy S8, an electrode is formed on the insulation film, covers selection transistors and drive transistors, and is connected to active elements through contact holes:

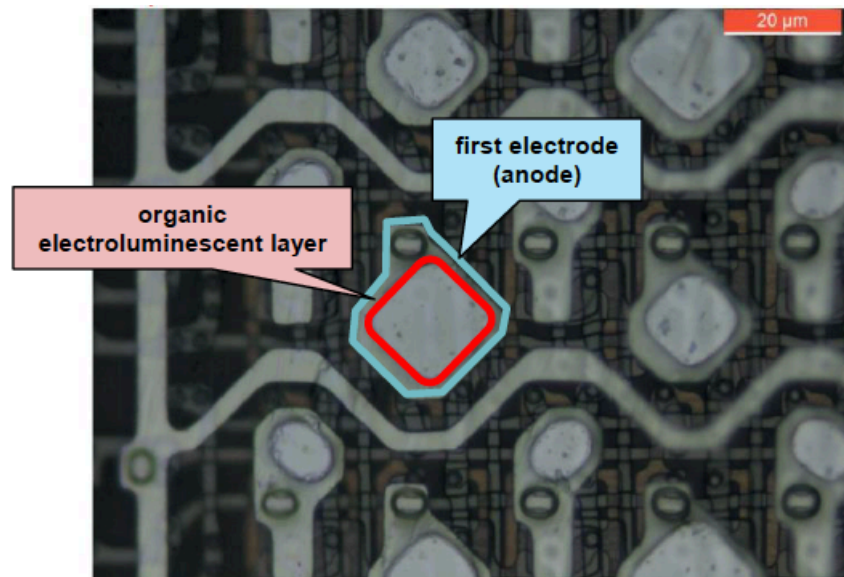


This electrode is formed of silver, which shields visible light.

*Claim Element*

*'450 Accused Instrumentalities*

The first electrodes are arranged in a matrix pattern in areas surrounded by the address lines and the data lines:

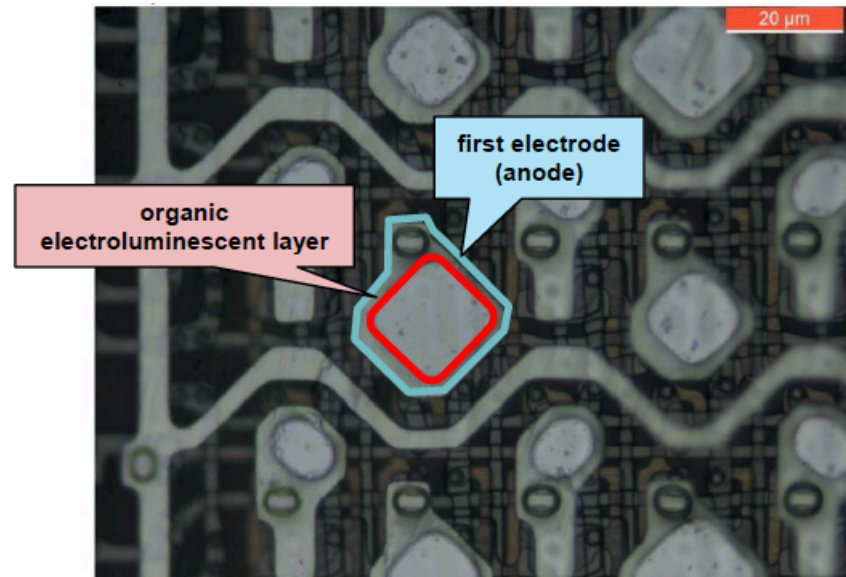


*Claim Element*

*'450 Accused Instrumentalities*

[15h] an organic electroluminescent layer formed on said first electrodes which covers said selection transistors and said drive transistors and including at least one layer which emits light in accordance with an applied voltage;

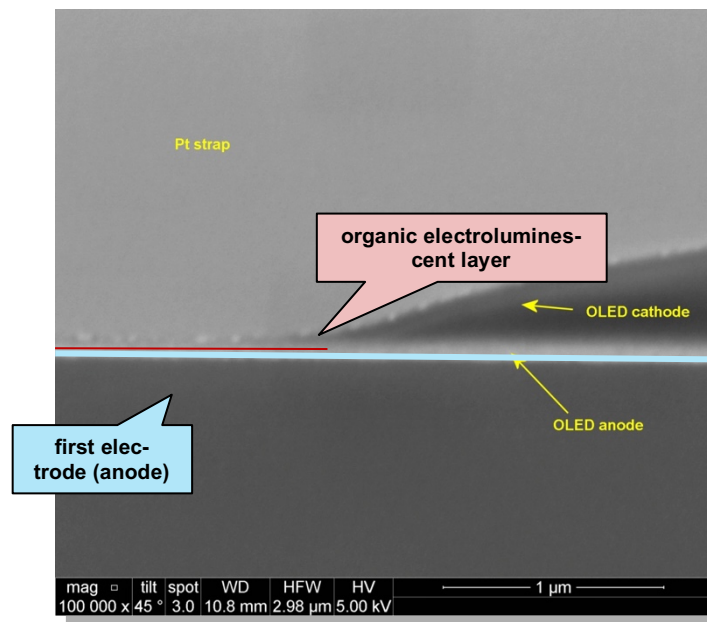
The '450 Accused Instrumentalities comprise an organic electroluminescent layer formed on said first electrodes which covers said selection transistors and said drive transistors and including at least one layer which emits light in accordance with an applied voltage. For example, in the Samsung Galaxy S8, a layer of organic electroluminescent material is formed on the electrode, and covers selection transistors and drive transistors:



*Claim Element*

*'450 Accused Instrumentalities*

This organic electroluminescent layer emits in accordance with a voltage applied to the layer using the OLED cathode and anode:



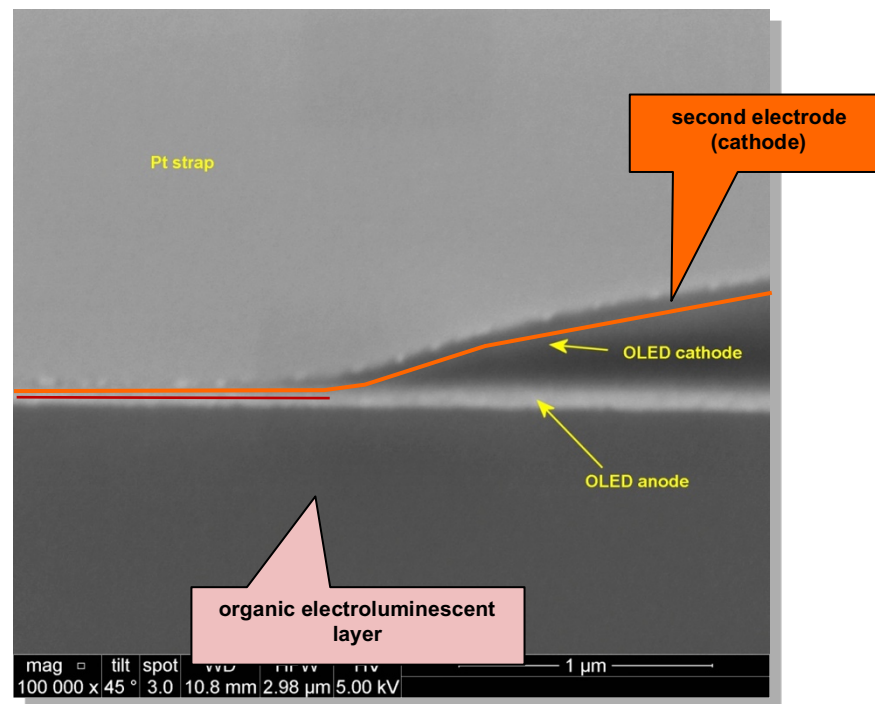


*Claim Element*

*'450 Accused Instrumentalities*

[15i] a second electrode formed on said organic electroluminescent layer which covers said selection transistors and said drive transistors;

The '450 Accused Instrumentalities comprise a second electrode formed on said organic electroluminescent layer which covers said selection transistors and said drive transistors. For example, in the Samsung Galaxy S8, a second electrode is formed on the organic electroluminescent layer covers selection transistors and drive transistors:



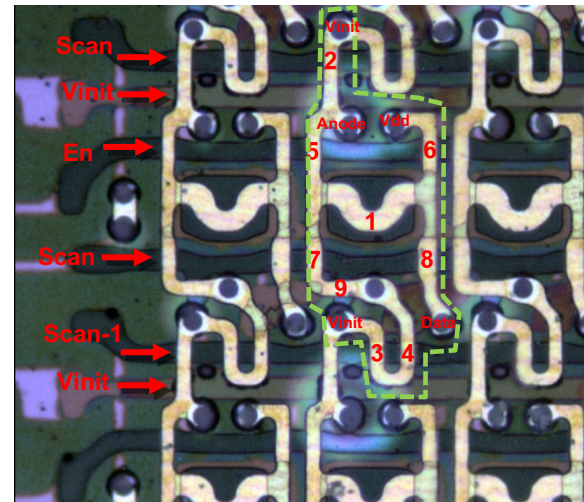


*Claim Element*

*'450 Accused Instrumentalities*

[15j] a first driver circuit for selectively supplying said address signal to said address lines in sequence; and

The '450 Accused Instrumentalities comprise a first driver circuit for selectively supplying said address signal to said address lines in sequence. For example, in the Samsung Galaxy S8, the selection transistors are turned on in response to externally supplied address signals, such as lines “Scan-1” and “Scan” shown below:



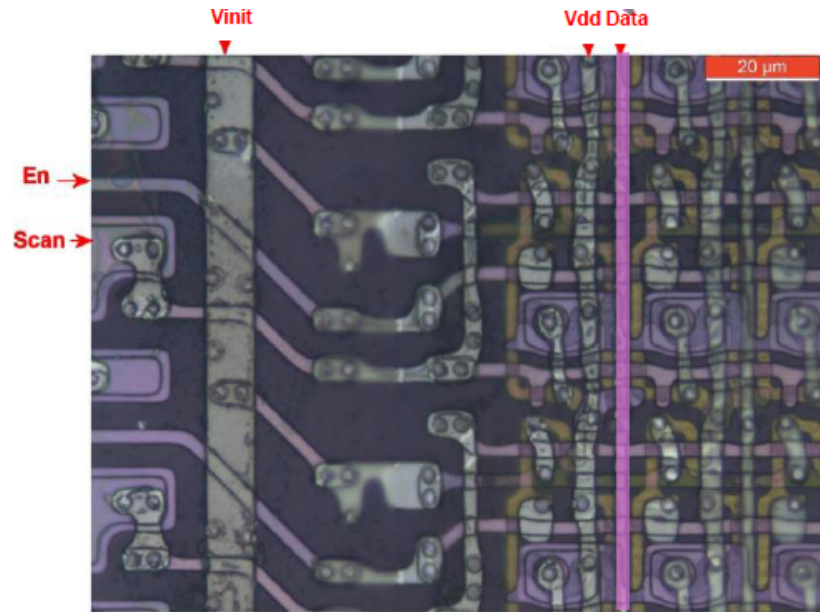
A driver circuit selectively supplies an address signal to these address lines in sequence, e.g., “Scan-1” followed by “Scan.”

*Claim Element*

*'450 Accused Instrumentalities*

[15k] a second driver circuit for supplying said image data to said data lines.

The '450 Accused Instrumentalities comprise a second driver circuit for supplying said image data to said data lines. For example, the Samsung Galaxy S8 contains data lines such as that labeled "Data" below:



A driver circuit drives the data lines with electrical signals containing the image data.

*Claim Element*

*'450 Accused Instrumentalities*

16. The display apparatus according to claim 15, wherein a constant voltage is applied to said second electrode.

The '450 Accused Instrumentalities comprise a display apparatus according to claim 15, wherein a constant voltage is applied to said second electrode. For example, in the Samsung Galaxy S8 a constant voltage is applied to said second electrode:

